Sensory and Physico-Chemical Quality Evaluation of Traditional, Improved and Commercially Dried *Puntius sophore*

MR Islam, MA Baten, AW Newaz*

Department of Fishing and Post Harvest Technology, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

*Correspondence: awnewaz.fpht@sau.edu.bd

ABSTRACT

To evaluate the sensory and physical-chemical qualities of traditional, improved, and commercial dried punti (*Puntius sophore*), an experiment was conducted. Fresh punti fish was procured and dried for this purpose utilizing both traditional (TD) and improved methods (ID). Commercially dried (CD) punti fish was also procured from regional markets. The sensory evaluation of the improved dried products revealed that they were of higher grade than both commercial- and tradition-style dried punti fish. According to the findings, enhanced dried punti rehydrated more quickly than traditional and store-bought dry punti. The dried punti's moisture content ranged from 14.20.45% (commercial dried punti) to 22.50.8% (improved dried punti). When compared to traditional and commercial dried fish, improved dried fish had the highest levels of crude protein, crude fat, and ash. After 30 days of storage, market dried punti was found to be infested with insects. However, it was discovered that both traditional and improved dried punti remained pest-free for up to 120 days of storage. The results indicated that the improved drying techniques produced the best dried fish product in terms of sensory, physico-chemical, and food safety aspects.

Keywords: *Puntius sophore*, dried fish, sensory properties, proximate composition, water reconstitution, insect infestation.

INTRODUCTION

Fish has always been considered one of the most valuable animal protein sources for human. In addition, fish serves as excellent source of minerals, polyunsaturated fatty acids (PUFA) especially Eicosa Pentaenoic acid (EPA) and Docosa Hexaenoic Acid (DHA) (Goswami and Manna 2019). Fish is also considered as highly perishable food commodity owing to its spoilage prone biochemical constituents. Fish contain large number of fatty acids with high degree of unsaturation that are always susceptible to oxidation by atmospheric oxygen. This phenomenon frequently gives rise to rancidity with off-odor especially observed in smoked and dried fish (Cho et al., 1989). Therefore, in order to prevent the spoilage, fish needs quick preservation of fish which includes salting or brining, sun drying, solar drying, air drying and smoking in smoking kilns (Mustapha et al., 2014). Among these, drying is cheapest method of fish preservation and dried products are easily transportable, marketable and storable (Hassan et al. 2013; Ahmed et al., 2007). The dry fish considered as a good source of protein, vitamins and minerals in the diet of people in many parts of the world including Asia and Europe (Paul et al., 2018). The traditional sun-drying method usually takes 3-7 days to produce dried fish products (Islam, et al., 2013). Apart from nutritional value, dried fish has considerably longer shelf life and requires no specialized facilities for storage (Immaculate et al. 2013; Reza et al. 2005). In Bangladesh, there are wide variety of fish species are used to produce dried products mainly small indigenous species including mola, dhela, chapila, punti, chanda, and batashi etc.

(Majumdar et al 2017). Most of the people of Bangladesh who are linked with traditional fish drying are illiterate (Azam, 2002). In Bangladesh, traditionally fish are dried open unhygienic environment under without ensuring food safety aspects. The dried fishes are often subjected to the insect attack or microbial spoilage due and the quality is severely compromised due to non-conducive weather condition. Available reports from previously conducted study suggested that the quality of majority of the traditional sundried products available in the market are not up to the mark for human consumption and sometime they even possess serious health hazards (Paul et al., 2018). Furthermore, traditionally produced dried fish are frequently found contaminated with different kinds of banned detrimental pesticides which are lethal for human health (Bhuiyan et al., 2009). Therefore, to overcome these quality issues of dried fish products and for ensuring the production of safe wholesome dried product, different kinds of improved drying methods with different pre-treatments of fish have been established (Kumar et al., 2017 and Roy et al., 2014).

Punti, also known as pool barb, is a well-known member of the Cyprinidae family and a significant source of micronutrients (Goswami and Manna, 2019). It is sold widely and regarded in Bangladesh, India, Myanmar, China, Nepal, and Bhutan as being incredibly nourishing and delicious. In Bangladeshi local markets, this species is easily accessible in fresh, dried, and fermented forms. Punti that has been traditionally prepared and dried is sold in Bangladeshi markets. It is evident that basic sanitation and hygiene standards are not upheld during the drying of fish; as a result, insect infestation, the presence of dirt, filth, and pesticide residue are extremely prevalent issues with the dried fish products of Bangladesh (Nowsad, 2007). Farmers commonly employ drying to preserve fish as a least expensive option. Therefore, it is required to design a better drying procedure that includes pre-treating the raw material in order to increase the dried fish's quality. The impact of various drying techniques on the sensory and physico-chemical quality evaluation of dried punti remains unsettling in Bangladesh despite the development of multiple improved drying methods, including solar drying and ring tunnel dryers. Consumers can find the best dried fish by evaluating its nutritional content and shelf life as well as by comparing other dried items. The goal of the current study was to determine the sensory and physico-chemical characteristics of market-grade, enhanced, and traditional dried *Puntius sophore*.

MATERIALS AND METHODS

Sample collection

Punti (*P. sophore*) is a widely known small indigenous species (SIS) of Bangladesh. For experimental purpose specimen of this species were collected from rice field of Kustia district, Bangladesh by using traditional fishing gear (charo, bana, khunkhuni, thela jal).

Sample preparation

Traditional drying (TD)

The collected fish washed in an earthen pot locally called ‘Dhuksa’ in Kushtia region. For drying purpose scales were first removed and then fishes were gutted by stripping the belly open. Stripped fishes were then washed thoroughly with clean water for 3-4 times. Finally, fish

samples were dried under direct sunlight in bamboo made tray (‘Kula’) placed on the rooftop for 5-6 days.

Improve drying (ID)

In improved drying technique fish samples were gutted and washed properly. As a part of pre-treatment, samples were mixed with 4-5% salt and 2-3% turmeric powder. Samples were placed in ‘kula’ for drying. Kula was then covered with thin polythene sheet which helped increase the temperature and provided protection against insect infestation. Samples were dried properly under sunlight within 2-3 days.

Commercially dried (CD)

Commercially dried (CD) punti sample was collected from the local markets located in Mohammadpur and Kawran Bazaar.

Sensory analysis

The sensory parameters such as appearance, color, flavor and overall preference of traditional, improved and market dried products were observed and all the samples were unbiasedly encoded prior to sensory evaluation. Ten experienced members (aged between 20 to 45 years) were selected from Sher-e-Bangla Agricultural University. Dried fish samples were examined on the basis of Hadonic scale where 9 denotes ‘extremely liked’ and 0 denotes ‘extremely disliked’ (Roy et al., 2014).

Water Reconstitution Analysis

Percentage of water is absorbed by dried sample at a certain temperature and time is called water reconstitution. It is used to assess the physical parameters of dried product (Prodhan and Kamruzzaman, 2011). Each sample was weighed by electric balance and kept it in a conical flask. The flask is placed in the water bath for an hour at room temperature, 50°c and 60°c and weighed at every 15 min intervals for each temperature.

Water reconstitution was determined by the following formula (Haque et al., 2013)-

$$\% \text{ Water reconstitution} = (Wr - Wi) / Wi \times 100$$

Wi = Initial weight of the dry fish

Wr = Weight of dry fish after reconstitution,

Wr – Wi = Water reconstitution

Proximate composition

Protein, Lipid, Moisture, and Ash contents of dried punti fishes were determined by using standard AOAC method (1995).

Observation of insect infestation in stored condition

TD, ID and CD punti were stored in room temperature for four months. Samples were observed at 30 days interval and records were kept.

RESULTS AND DISCUSSION

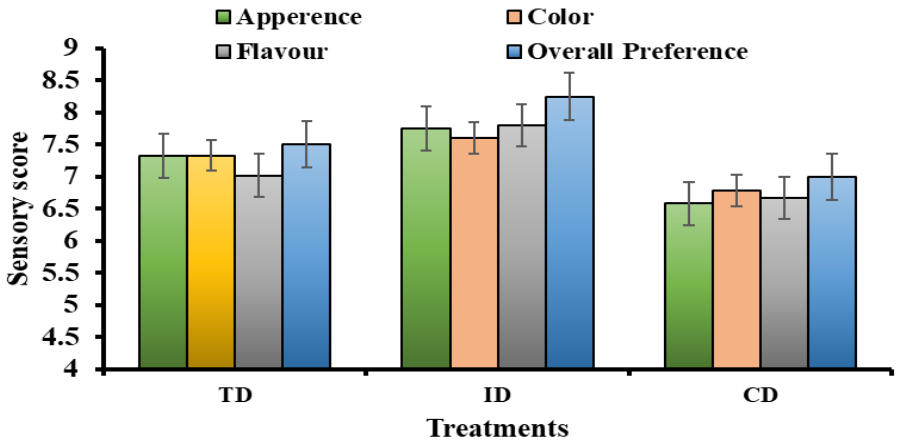

Fig. 1 Effect of the drying methods on the sensory properties of *P. sophore*

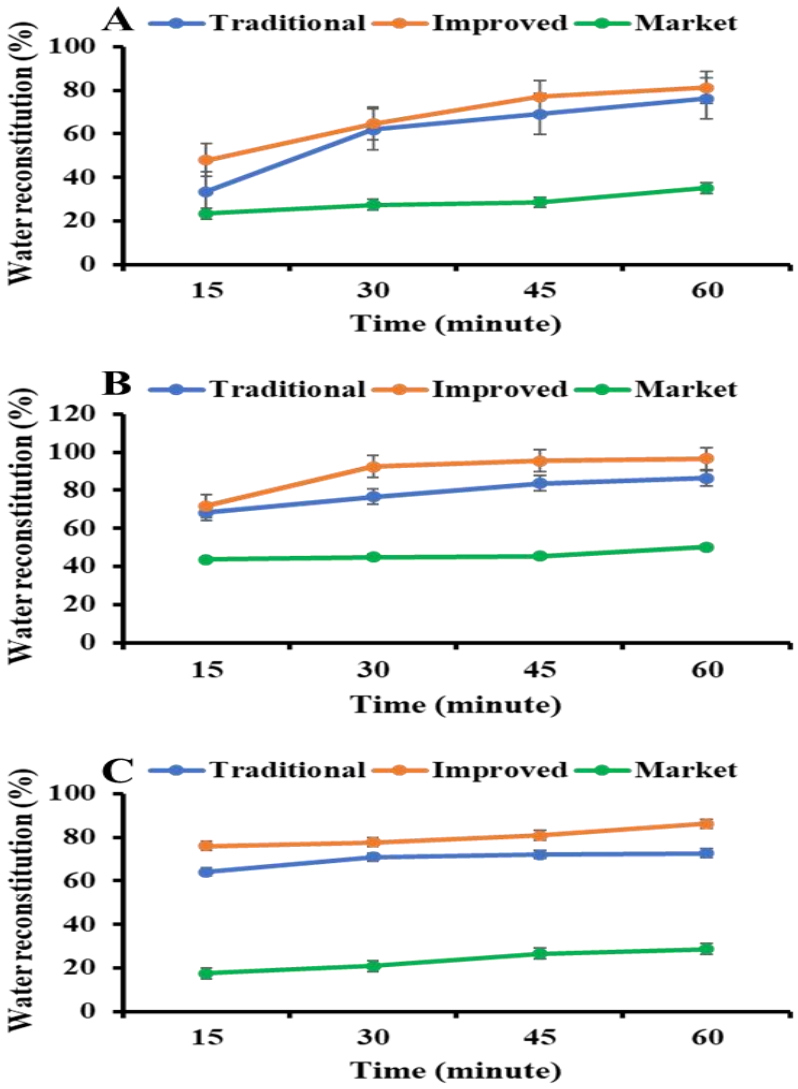

Fig. 2 Water reconstitution property of *P. sophore* at (A) room temperature, (B) 50 ºC and (C) 60 ºC for the different drying methods

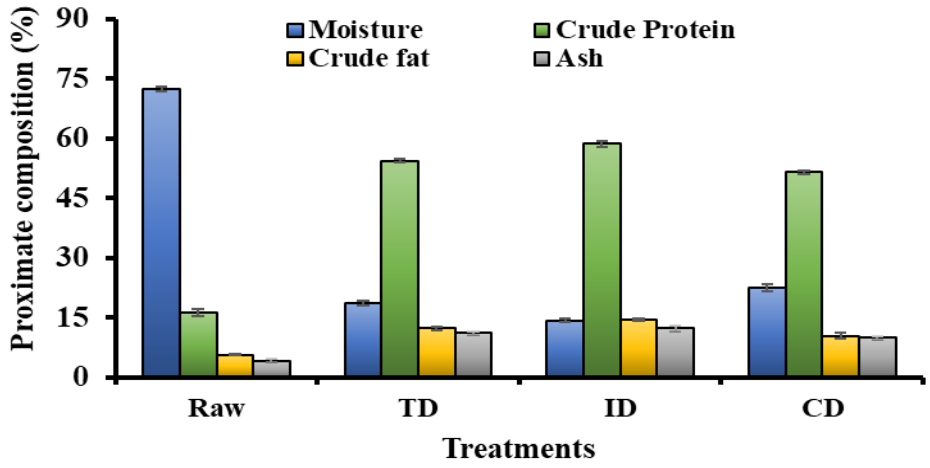

Fig. 3 Comparison of proximate compositions of fresh and dried *P. sophore* processed under different drying methods

Fig. 4 Observation of insect infestation in traditional dried-TD (A), improved dried-ID (B) and commercially dried-CD *P. sophore*

Sensory analysis of dried Punti fish

In case of improved dried punti (*P. sophore*), significantly the higher Hadonic scale values of were found for appearance, color, flavor and overall preference when compared to traditional and market dried Punti (Figure 1). The values recorded for traditionally dried method secured second position followed by commercially available dried punti collected from different market.

Water reconstitution property of sundried Punti

The results of the present study revealed that at ambient temperature (28-30°C), CD punti showed poor water reconstitution property with moisture content of 35.06% after 60 min of soaking. Whereas, in case of TD and ID dried punti comparatively higher water-holding capacity was observed after same duration of soaking with moisture content of 76.19% and 81.25%, respectively (Figure 2A). On the other hand, at 50°C and 60°C temperature CD, TD and ID punti showed a moisture content of 50.18%, 28.69%, 86.25% (Figure 2B) and 72.62%, 96.58% and 86.15% (Figure 2C) after 60 minutes soaking, respectively.

Proximate composition of sundried Punti

The moisture content of the dried *P. sophore* ranged from 22.5±0.8% to 14.2±0.45 on a wet matter basis where the moisture content of fresh fish was 72.33±0.5%. After completion of

drying, final moisture content of TD, CD and ID punti was recorded as 18.65±0.6%, 22.5±0.8% and 14.2±0.45%, respectively. Comparatively lower moisture content was found in the ID product in compare with the TD and CD. Following the similar trend in terms of quality, the highest protein content was observed for ID punti fish (58.55±0.67%) whereas the lowest value was found in the CD fish (51.45±0.55 %) collected from market. The lipid content of dried fish ranged between 14.4±0.33% to 10.43±0.66%, with highest value in ID fish product. The highest ash or mineral content of dried punti found in ID product (12.3±0.75%) and lowest in (9.87±0.57%) in CD punti fish. The average moisture, crude protein, crude fat and ash content of collected raw fresh punti specimens were 72.33±0.5% 16.25±0.77%, 5.68±0.23% and 4.1±0.44%, respectively (Figure 3).

Insect infestation

All three types of dried fish samples were packed in airtight zipper bag and stored in room temperature for 120 days. The study found insect infestation occurred in CD punti after 30 days of storage. On the other hand, any sort of insect infestation was apparently present in both TD and ID *P. sophore* within 120 days period of stored (Figure 4).

Dried fish is a highly popular and delectable cuisine in Bangladesh and other nations. The preparation of dried fish often involves a variety of drying techniques and pre-treatments. The biochemical, microbiological, and sensory characteristics of the dried fish are significantly influenced by these various techniques.

Using panel members' senses and the Hadonic scale approach, sensory analysis including appearance, color, flavor, and overall preference of dried fish were evaluated to estimate quality. The overall acceptance of the dried fish produced using the enhanced drying technique, the conventional drying technique, and the market dried punti, respectively, was found to be greater. It has been asserted that a dried fish's sensory score correlates with the quality of the product, and that the opposite is also true (Sultana et al., 2011; Roy et al. 2014). Market-available sun-dried fish had unappealing appearance, color, and flavor, whereas dried fish made using the solar tunnel drying process had significantly higher quality in all respects (Rahman et al 2012). Our findings suggested that compared to dried fish produced using the traditional approach and purchased from the market, fish produced using the improved drying process exhibited slightly higher quality.

The capacity of dried fish to hold water increases with increased soaking time and temperature (Akintunde et al., 2008). Overall, the fish that was dried using the improved approach rehydrated more quickly than fish that was dried using the conventional method or purchased at the market. According to some reports, warmer water can cause fish muscles to become more permeable, speeding up the process of water absorption (Akintunde et al., 2008). Reza et al. (2005) have noted that the physical characteristics of dried fish have a favorable impact on rehydration ability. Furthermore, in addition to time and temperature, the capacity of dried fish to absorb water depends on the species (Rasul et al., 2018).

With longer soaking times and warmer temperatures, dried fish may hold more water (Akintunde et al., 2008). Overall, compared to fish dried using the traditional method or fish bought at the market, fish dried using the improved method rehydrated more quickly. Some reports claim that fish muscles can become more porous in warmer water, accelerating the process of water absorption (Akintunde et al., 2008). According to Reza et al. (2005), dried fish's physical attributes have a positive influence on its capacity to rehydrate. The ability of dried fish to absorb water also depends on the diversity of species, in addition to time and temperature. When fish was treated with salt to help lower its water activity more quickly, the improved products showed relatively lower levels of moisture content. According to Hasan et al. (2006), some small indigenous species' conventional and solar-dried products had moisture contents that varied from 26.02% to 27.33% and 13.71% to 19.30%, respectively.

The protein content of the dried fish produced using conventional, improved drying methods, and market samples was 54.350.3%, 58.550.67%, and 51.450.55%, respectively. These figures were confirmed by Hasan et al. (2006), who discovered that the protein content of dried fish species ranged from 44.72% to 60.33%, and that the protein content of other small dried fish species also ranged from 44.72% to 60.33%. According to report of Azam et al. (2003) on the biochemical analysis of a few dried fish products, the protein content ranged from 40.69 to 66.52%. The dehydration of water molecules between the proteins, which led to the protein aggregation, increased the protein level in the dried fish (Nagwekar et al. 2016, Ullah et al., 2016).

The dried fish that was acquired from the market had the lowest amount of lipids, which may be because conventional drying procedures cause lipids to oxidize more quickly. According to reports, dried fish purchased from the market had a higher moisture content than dried fish produced using an improved drying technology, which had higher protein and fat values (Immaculate et al., 2012).

On the other hand, the lipid content of various dried fish species ranges from 14.40.33% to 10.430.66%, with improved dried fish having the highest and market dried fish having the lowest amounts. The results of Hasan et al. (2006), who found that the lipid content of dried fish species ranged from 8.91% to 18.07%, supported these numbers. These values fall within the range reported by Flowra and Tumpa (2012), who found dried fish samples with lipid contents ranging from 5.38% to 15.86%.

The ash percentage of several dried fish species ranged from 9.870.57% to 12.30.75%, with market dried fish having the lowest value and improved dried fish having the greatest value. The market sample of the improved dried fish included the largest level of ash, which may have been caused by contamination with sand and dirt during drying. This data is almost identical to that of Azam et al. (2003), who discovered that the ash percentage of dried fish ranged from 5.08 to 12.14%. Our findings concur with those of Nurullah et al. (2006), who reported that the ash percentage of various dried fish species ranges from 9% to 19.32%. But there was no significant difference observed in the protein, lipid, or ash content in the dried fish produced by the various drying methods on a dry matter basis.

In the case of an insect infestation, it was found that traditional and improved dried products performed better, however market goods performed poorly because of the insect infestation. According to a study, insect infestation in dried goods is a significant issue when drying fish (Flowra et al., 2013). Fish processors typically employ hazardous chemical pesticides without taking into account the deadly consequences of these pesticides on customer bodies to protect dried fish from insect infestation. The most typical insecticides used in dried fish to prevent insect infestation are DDT and Nogos (Nowsad, 2007).

CONCLUSION

The results of this study revealed that different drying methods with different pre-treatments have a significant role on the physico-chemical and sensory properties of the dried *P. sophore*. Sensory and physico-chemical characteristics were highly acceptable for the improved dried fish products, where fish were pre-treated with salt (4-5%) and turmeric (2-3%). The market dried fish were of comparatively poor quality in terms of proximate composition, sensory analysis and water rehydration when compared with the traditional and improved dried fish products. Our results indicate that the dried fish produced by the improved drying method showed comparatively better quality than the dried fish produced by the conventional drying methods.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interests.

ACKNOWLEDGEMENT

The research work was carried out under the financial support of Ministry of Science and Technology, Peoples Republic of Bangladesh through “Fish diversity and Ecosystem Services of Dubla Island (Dublar Char)” Project during 2021-22 financial year.

REFERENCES

Ahmed M, MN Islam and M Shamsuddoha (2007): Value chain analysis in the dry fish production and marketing of postharvest fishery products (PHFP) in the Coastal Belt of Bangladesh. Journal of Bangladesh Fisheries Research Forum, 2007: 87-112.

AOAC (Association of Official Analytical Chemists) (1995): Official methods of analysis, 13th Edn., Association of Official Analytical Chemists, Washington DC.

Azam K (2002): Fisherman community of Kuakata, Bangladesh: Fisheries activities and quality of fish. Proceedings of SUFER Project (DFID-UGC), Khulna University.

Azam K, MZ Basher, M Asaduzzaman, MM Hossain and My Ali (2003): Biochemical quality assessment of fourteen selected dried fish. University Journal of Zoology, Rajshahi University. 22: 23–26.

Bhuiyan MNH, M Dawlatana, HR Bhuiyan, FA Lucky, BK Saha and MNI Bhuiyan (2009): Quality assessment of dry fishes of Bangladesh with the special emphasis on harmful additives. Bangladesh Journal of Scientific and Industrial Research, 44(3): 311–318.

Cho SY, Y Endo, K. Fujimoto, and T. Kaneda (1989): Oxidative Deterioration of Lipids in Salted and Dried. Nippon Suisan Gakk, 55: 541–544.

Flowra FA, AS Tumpa, and MT Islam (2012): Biochemical analysis of five dried fish species of Bangladesh. University Journal of Zoology, Rajshahi University, 31: 9–11.

Flowra FA, AS Tumpa, and MT Islam (2013): Study on the insect infestation of dry fishes at Singra. Journal of Asiatic Society of Bangladesh Science, 39: 273–277.

Goswami S, and K Manna (2019): Nutritional Analysis and Overall Diet Quality of Fresh and Processed (Sun-dried and Fermented) *Puntius sophore*. Current Research in Nutrition and Food Science Journal, 7(2): 360–368.

Haque E, M. Kamruzzaman, MS Islam, T Sarwar, SS Rahman and MR Karim (2013): Assessment and comparison of quality of solar tunnel dried Bombay duck and silver pomfret with traditional sundried samples. International Journal of Nutrition and Food Sciences, 2(4): 187–195.

Hassan MM, FH Shika, MI Hossain, M Kamal, MN Islam, MA Wahab (2006): Quality assessment of traditional, rotary and solar tunnel dried small indigenous fish species products. Bangladesh Journal of Fisheries Research, 10:73–84.

Hassan MN, M Rahman, MM Hossain, AAKM Nowsad, and MB Hossain (2013): Post-harvest loss and shelf life of traditionally smoked shrimp products produced in Bangladesh. World Journal of Fisheries and Marine Science, 5(1): 14–19.

Immaculate J, P Sinduja and P Jamila (2012): Biochemical and microbial qualities of *Sardinella fimbriata* sun dried in different methods. International Food Research Journal, 19(4): 1699–1703.

Islam MT, S Ahmed, MA Sultana, AS Tumpa and FA Flowra (2013): Nutritional and food quality assessment of dried fishes in Singra upazila under Natore district of Bangladesh. Trends in fisheries Research, 2(1), 2319–4758.

Kumar GP, KM Xavier, BB Nayak, HS Kumar, G Venkateshwarlu and AK Balange (2017): Effect of different drying methods on the quality characteristics of *Pangasius hypophthalmus*. International Journal of Current Microbiology and Applied Sciences, 6(10): 184–195.

Majumdar BC, F Afrin, MG Rasul, M Khan and AKMA Shah (2017): Comparative study of physical, chemical, microbiological and sensory aspects of some sun-dried fishes in Bangladesh. Brazilian Journal of Biological Sciences, 4(8): 323–331.

Mustapha MK, TB Ajibola, AF Salako and SK Ademola (2014): Solar drying and organoleptic characteristics of two tropical African fish species using improved low-cost solar driers. Food Science & Nutrition, 2(3): 244–250.

Nagwekar N, V Tidke, BN Thorat (2016): Microbial and Biochemical Analysis of Dried Fish and Comparative Study Using Different Drying Methods. Drying Technology, 35(12): 17–22.

Nowsad, A. K. M. (2007). Participatory training of trainers: a new approach applied in fish processing. BFRF. Dhaka. pp. 151–197.

Nurullah M, M Kamal, MA Wahab, MN Islam, MS Reza, SH Thilsted and MA Mazid (2006): Quality assessment of traditional and solar tunnel dried SIS (Small Indigenous Fish Species) products. Bangladesh Journal of Fisheries Research,10(1): 63–72.

Paul PC, MS Reza, MN Islam and M Kamal (2018): Quality assessment of traditionally dried marine fish of Bangladesh. Asian Food Science Journal, 5(1): 1-11.

Prodhan S and M Kamrujjaman (2011): Preservation of dried *Scomberomorus guttatus* by radiation and heat: Analysis of bio-chemical composition, quality and reconstitution properties. LAP LAMBERT Academic Publishing, Germany. pp. 152.

Rahman MJ, E Karim, MS Uddin, M Zaher and MA Haque (2012): Development of low-cost emergency fish dryer in Bangladesh to use in absence of sunlight. Bangladesh Research Publication Journal, 7: 267–276.

Rasul M, BC Majumdar, F Afrin, MAJ Bapary and AKMA Shah (2018): Biochemical, microbiological, and sensory properties of dried silver carp (*Hypophthalmichthys molitrix*) influenced by various drying methods. Fishes, 3(3): 25.

Reza MS, MAJ Bapary, KM Azimuddin, M Nurullah and M Kamal (2005): Studies on the traditional drying activities of commercially important marine fishes of Bangladesh. Pakistan Journal of Biological Sciences, 8(9): 1303–1310.

Roy VC, M. Kamal, M Faridullah, SA Haque and MS Reza (2014): Influence of salt and herbal substance on the drying and reconstitution performance of Bombay duck, *Harpodon nehereus*. Journal of Fisheries, 2(1): 59–63.

Sultana S, S Parween and MA Hossain. (2011): Biochemical analysis of some dried SIS fishes of the River Padma in Rajshahi. Journal of Life and Earth Science, 6: 39–43.

Tunde-Akintunde TY (2008): Effect of soaking water temperature and time on some rehydration characteristics and nutrient loss in dried bell pepper. Agricultural Engineering International: CIGR Journal, 10:1–7.

Ullah N, P Hazarika and PJ Handique (2016): Biochemical quality assessment of ten selected dried fish species of north east India. International Advanced Research Journal in Science, Engineering and Technology, 3(1): 30–33.